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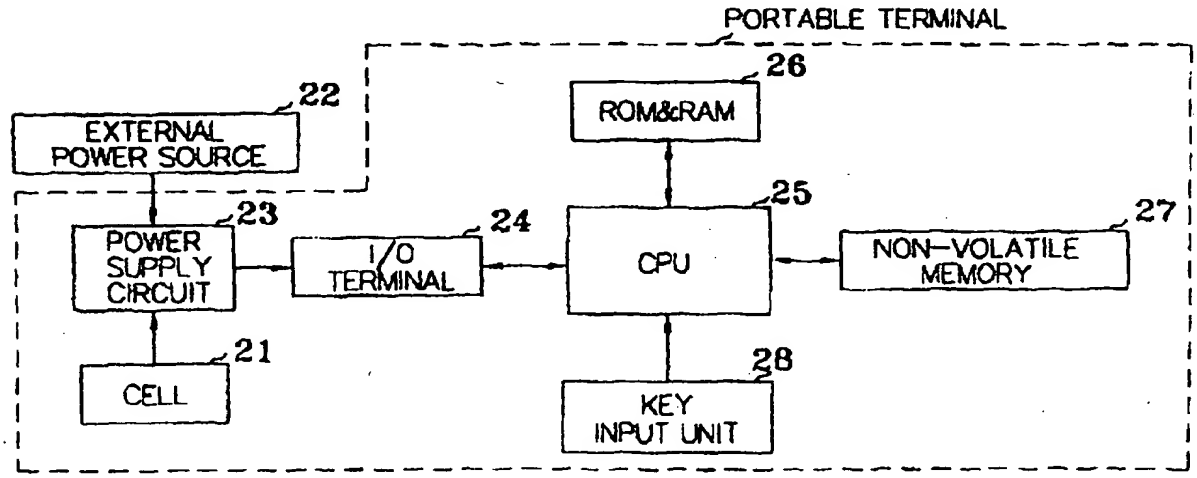
(54) Memory management method for portable terminal

(57) A memory management method for a portable terminal can prolong the lifetime of an internal battery in the portable terminal. The memory management method in a portable terminal using a non-volatile memory (27) is provided in which a recording operation is first performed in an unused memory region, an address value with respect to data to be deleted is registered in a delete queue, and then the data to be deleted is deleted all at a time when external power (22) is supplied, to thereby reduce power consumption of a cell (21) in a portable terminal using a limited capacity of the cell (21) and prolong an operation time of an internal cell (21). Data can be recovered when a user desires recovery of the data, unless the data corresponding to address values recorded in the delete queue is deleted all at a time.

FIG. 2



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Descripti n

The present invention relates to a memory management method for a portable terminal using a non-volatile memory, and more particularly, to a memory management method for a portable terminal which can prolong the lifetime of an internal battery in the portable terminal.

As the desire of computer user's for increased information processing capability rises, the number of programs to be used increases and the size of each program grows. As a result, the required capacity of a memory contained in a computer becomes larger and larger. The memory is divided into volatile memory and non-volatile memory. The non-volatile memory is a storage device for maintaining stored information even when power is not applied thereto. An EEPROM or flash memory is a known example of a non-volatile memory.

Figure 1 is a flowchart diagram for explaining a data recording method of a general recording system using a non-volatile memory as a storage device. In step 110, it is judged whether or not a recording command for recording data is input. If the data recording command is input, previous data already stored in a corresponding region in a memory is deleted for the first time (step 120). Then, new data is recorded in the corresponding region in the memory (step 130). That is, when new data is recorded, the previous data recorded in the corresponding region in the memory should be deleted according to a predetermined sequence, to then record the new data. Thus, a controller such as a CPU should continuously check the state of the memory for recording and deletion of data. Such a continuous memory check of the controller causes unnecessary power consumption, and power consumption due to deletion and recording of data occurs. Also, in a portable terminal which uses a limited capacity of power source such as a galvanic cell, a power operating time is shortened due to power consumption resulting from frequent deletion and recording of data.

Thus, a portable terminal using a non-volatile memory requires a new memory management method capable of prolonging the lifetime of an internal cell.

With a view to solve or reduce the above problems, it is an aim of preferred embodiments of the present invention to provide a memory management method in a portable terminal, in which a recording operation is first performed in an unused memory region, an address value for data to be deleted is registered in a delete queue, and then the data to be deleted is deleted all at a time when external power is supplied, to thereby prolong an operation time of an internal cell.

According to a first aspect of the present invention, there is provided a memory management method in a portable terminal, in which power is supplied from an internal cell or an external power source and a non-volatile memory is used as a storage device, the memory management method comprising the steps of: (a) setting a delete queue in order to register corresponding address values in a memory region in which data to be deleted has been recorded; (b) judging whether or not a recording command for recording data in the memory is input; (c) judging whether or not an idle region exists in the memory when the recording command is applied; (d) recording data in the corresponding idle region when the idle region exists; (e) judging whether or not a delete command for deleting the data recorded in the memory is input; (f) registering corresponding address values in the memory region in which the data to be deleted has been recorded in the delete queue when the delete command is input; (g) judging whether or not power is supplied from the external power source; and (h) deleting the address values registered in the delete queue and the data of the corresponding regions indicated by the address values when the power is supplied for the external power source.

Preferably, said step (a) sets the delete queue in a first-in-first-out form so that the corresponding address values in the memory regions to be deleted are delet d in registered sequence.

The method may comprise the step of deleting, in sequence, corresponding address values and data in the corresponding regions indicated by the address values from the oldest address value registered in the delete queue as needed when the idle region is less than a region necessary for recording the data.

Preferably, it is judged whether or not said external power is supplied via the output signal of an input/output (I/O) terminal connected between a power supply circuit and a central processing unit (CPU).

Preferably, said CPU judges that external power is supplied when the output signal of said I/O terminal is an interrupt signal or a polling signal.

According to a second aspect, there is provided a memory management method in a portable terminal in which power is supplied from an internal cell or an external power source and a non-volatile memory is used as a storage device, the method comprising: (a) setting up a delete queue to register memory address values of data to be deleted following a delete command; (b) if the external power source is not connected then, following detection of a delete command adding memory address values of the data to be deleted to said delete queue; and (c) if it is detected that the external power source is connected, then deleting said data from the memory addresses stored in said delete queue and d - leting said delete queue.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a flowchart diagram for explaining a data recording method of a general recording system using a non-volatil m mory as a storage device;

Figure 2 is a block diagram showing the structure

of a portable terminal to which the present invention is applied;

Figure 3 is a flowchart diagram for explaining a memory management method for a portable terminal according to a preferred embodiment of the present invention; and

Figures 4A through 4F are views for explaining data deletion and delete queue in the memory by the Figure 3 method.

Preferred embodiments of the present invention will be described with reference to the accompanying drawings.

In Figure 2, a portable terminal includes a cell 21 which is a main power supply. The cell 21 supplies power to a power supply circuit 23. Also, the power supply circuit 23 can receive power from an external power source 22 in addition to the power supplied from the cell 21. The external power source 22 is positioned at the outside of the portable terminal, and is connected to the power supply circuit 23 in order to supply power to the portable terminal such as the cell 21 or supply power for charging the cell 21. The power supply circuit 23 supplies the power applied from the cell 21 or the external power source 22 to a central processing unit (CPU) 25. An input/output (I/O) terminal 24 is connected between the power supply circuit 23 and the CPU 25 to discriminate the power applied from both power sources 21 and 22. The I/O terminal 24 detects a point of time at which power is supplied from the external power source 22 to the power supply circuit 23. Also, the Figure 2 apparatus includes a ROM and RAM 26 and a non-volatile memory 27. The CPU 25 controls recording and deletion of the data. A key input unit 28 for receiving a key signal from a user is connected to the CPU 25.

Figure 3 is a flowchart diagram for explaining a memory management method for a portable terminal according to a preferred embodiment of the present invention. The memory management method for a portable terminal according to the present invention will be described in more detail with reference to Figures 2 and 3.

The CPU 25 detects a key signal input from the key input unit 28 and judges whether a data recording command is input or a data recording command is generated fro the data produced during execution of a program (step 310). If a data recording command is not input, the program jumps to step 350. However, if a data recording command is input, it is judged whether or not an idle region in which data is not recorded exists in the non-volatile memory 27 (step 320). If an idle region does exist, data is recorded in the idle region (step 330). If no idle r gion large enough to accommodate the amount of data to be recorded exists, then a minimum recording region is made for r cording the data. That is, previously record d data is deleted, so that a region larg enough for recording the data is obtained (step 340). Then, the program returns to step 330.

Subsequently, it is judged whether or not a data deletion command is input (step 350). If a data deletion command is not input, the program returns to step 370. However, if a data deletion command is input, address values of the data to be deleted are recorded in a delete queue (step 360). Then, the CPU 25 judges whether or not the external power source 22 is connected to the portable terminal (step 370). It can be seen via the I/O terminal 24 whether or not the external power source 22 is connected. The I/O terminal 24 confirms connection with or disconnection from the external power source 22 at an interrupt mode or a polling mode. When the external power source 22 is connected to the portable terminal and external power is supplied thereto, the CPU 25 deletes all at once the address values recorded in the delete queue and the data of the corresponding region indicated by the address values (step 380). Meanwhile if the external power source 22 is not connected thereto, the program returns to step 310.

Figures 4A through 4F are views for explaining data recording and deletion in the memory by the memory management method. Figures 4A through 4F show a memory map showing data recording regions and addresses A1, A2, A3 and A4 of each uniformly divided recording region in the non-volatile memory 27, and a delete queue for registering the address values of data to be deleted among the data recorded in the memory map. The delete queue has a first-in-first-out pattern in which a memory region to be deleted is sequentially registered. The delete queue is set in a portion in the non-volatile memory 27, or set in a certain region of an external memory such as a ROM and RAM 26.

Figure 4A shows a state where no data is recorded in the non-volatile memory 27. Figure 4B shows a state where data D1 is recorded in the corresponding regions having the address values A1 and A2 of the non-volatile memory 27. That is, when data is recorded, data is recorded in the empty regions having address values A1, A2, A3 and A4 of the non-volatile memory 27 as shown in Figure 4A. Figure 4C shows a change of the memory map and delete queue when data D2 is applied to update the data D1 recorded in the non-volatile memory 27. Here, regions which can be used for recording are idle regions having address values of A3 and A4. The data D2 for updating the data D1 is recorded in the empty regions. Also, the address values A1 and A2 of the memory map in which the previous data D1 has been recorded are registered in the delete queue one after the other.

Meanwhile, idle regions are insufficient for recording data D3, for example, only the idle region is left as shown in Figure 4C. Here, if data D3 to be recorded requires two idle regions, the oldest address values among the address values registered in the delete queue and the previous data r corded in the corresponding regions indicat d by the oldest address values

are deleted. Therefore, the oldest address value A1 is del ted, and then the previous data which is D1 recorded in the regions indicated by the address values A1 is deleted. Figure 4D shows a memory map from which the data has been deleted in the region A1 and a delete queue from which the address value A1 has been deleted. When a necessary idle region is secured in the above operation, data D3 to be recorded is recorded in the regions indicated by the address values A1 and A4. Figure 4E shows that an address value A3 in the memory region in which the previous data D2 has been recorded is recorded in the delete queue when data D3 to be newly recorded is update data with respect to the previously recorded data D2. Figure 4F shows that address values A3 and A2 registered in the delete queue and data D1 and D2 in the regions indicated by the address values are deleted all at a time when external power is input.

As described above, the present invention minimizes a deletion process for previously, recorded data when data is recorded, to thereby reduce power consumption of a cell in the portable terminal using a limited capacity of the cell and prolong the lifetime at its maximum. Also, the present invention can recover data when a user desires recovery of the data, unless the data corresponding to address values recorded in the delete queue is deleted all at a time.

While only one embodiment of the invention has been specifically described herein, it will be apparent that numerous modifications may be made thereto without departing from the scope of the invention.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any nov l combination, of the steps of any method or process so disclos d.

Claims

1. A memory management method in a portable terminal in which power is supplied from an internal cell (21) or an external power source (22) and a nonvolatile memory (27) is used as a storage device, the memory management method comprising the steps of:

   (a) setting up a delete queue to register corresponding address values in a memory region in which data to be deleted has been recorded;

   (b) judging (STEP 310) whether or not a recording command for recording data in the memory (27) is input;

   (c) judging (STEP 320) whether or not an idle region exists in the memory (27) when the recording command is applied;

   (d) recording (STEP 330) data in the corresponding idle region when the idle region exists;

   (e) judging (STEP 350) whether or not a delete command for deleting the data recorded in the memory (27) is input;

   (f) registering (STEP 360) corresponding address values in the memory region in which the data to be deleted has been recorded, in the delete queue when the delete command is input;

   (g) judging (STEP 370) whether or not power is supplied from the external power source (22); and

   (h) deleting (STEP 380) the address values registered in the delete queue and the data of the corresponding regions indicated by the address values when the power is supplied from the external power source (380).

2. The memory management method according to claim 1, wherein said step (a) sets the delete queue in a first-in-first-out form so that the corresponding address values in the memory regions to be deleted are deleted in registered sequence.

3. The memory management method according to claim 1 or 2, further comprising the step of deleting, in sequence, corresponding address values and data in the corresponding regions indicated by the address values from the oldest address value registered in the d lete queue as needed when the idle region is less than a region necessary for recording

the data.

4. The memory management method according to claim 1, 2 or 3, wherein it is judged whether or not said external power is supplied via the output signal of an input/output (I/O) terminal connected between a power supply circuit (23) and a central processing unit (CPU) (25).

5. The memory management method according to claim 4, wherein said CPU (25) judges that external power is supplied when the output signal of said I/O terminal (24) is an interrupt signal.

6. The memory management method according to claim 4, wherein said CPU (25) judges that external power is supplied when the output signal of said I/O terminal (24) is a polling signal.

7. A memory management method in a portable terminal in which power is supplied from an internal cell (21) or an external power source (22) and a non-volatile memory (27) is used as a storage device, the method comprising:

(a) setting up a delete queue to register memory address values of data to be deleted following a delete command;

(b) if the external power source is not connected then, following detection of a delete command, adding memory address values of the data to be deleted to said delete queue; and

(c) if it is detected that the external power source is connected, then deleting said data from the memory addresses stored in said delete queue and deleting said delete queue.

8. A method according to claim 7 further comprising any one or more features from the accompanying claims, description, Figures or abstract, in any combination.

FIG. 1 (PRIOR ART)

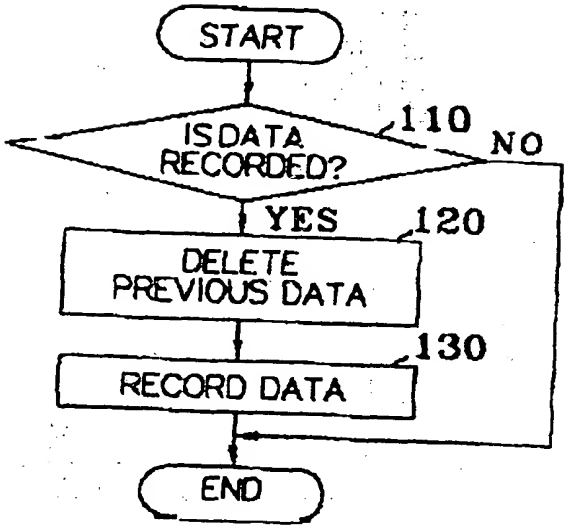


FIG. 2

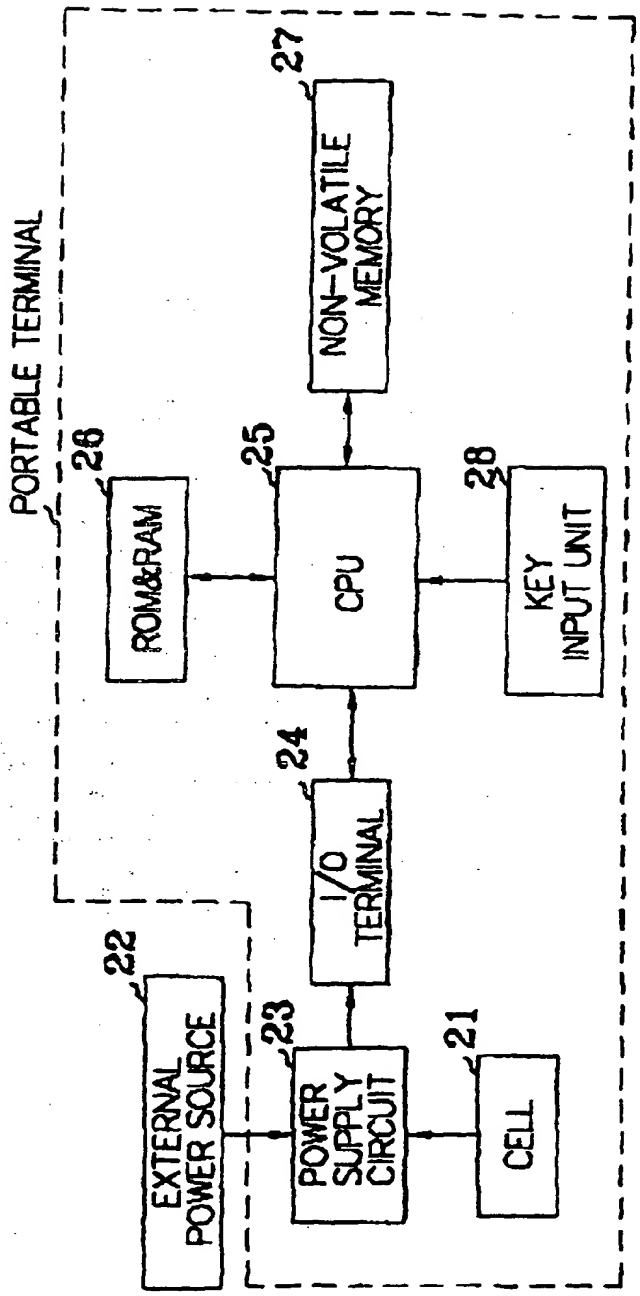
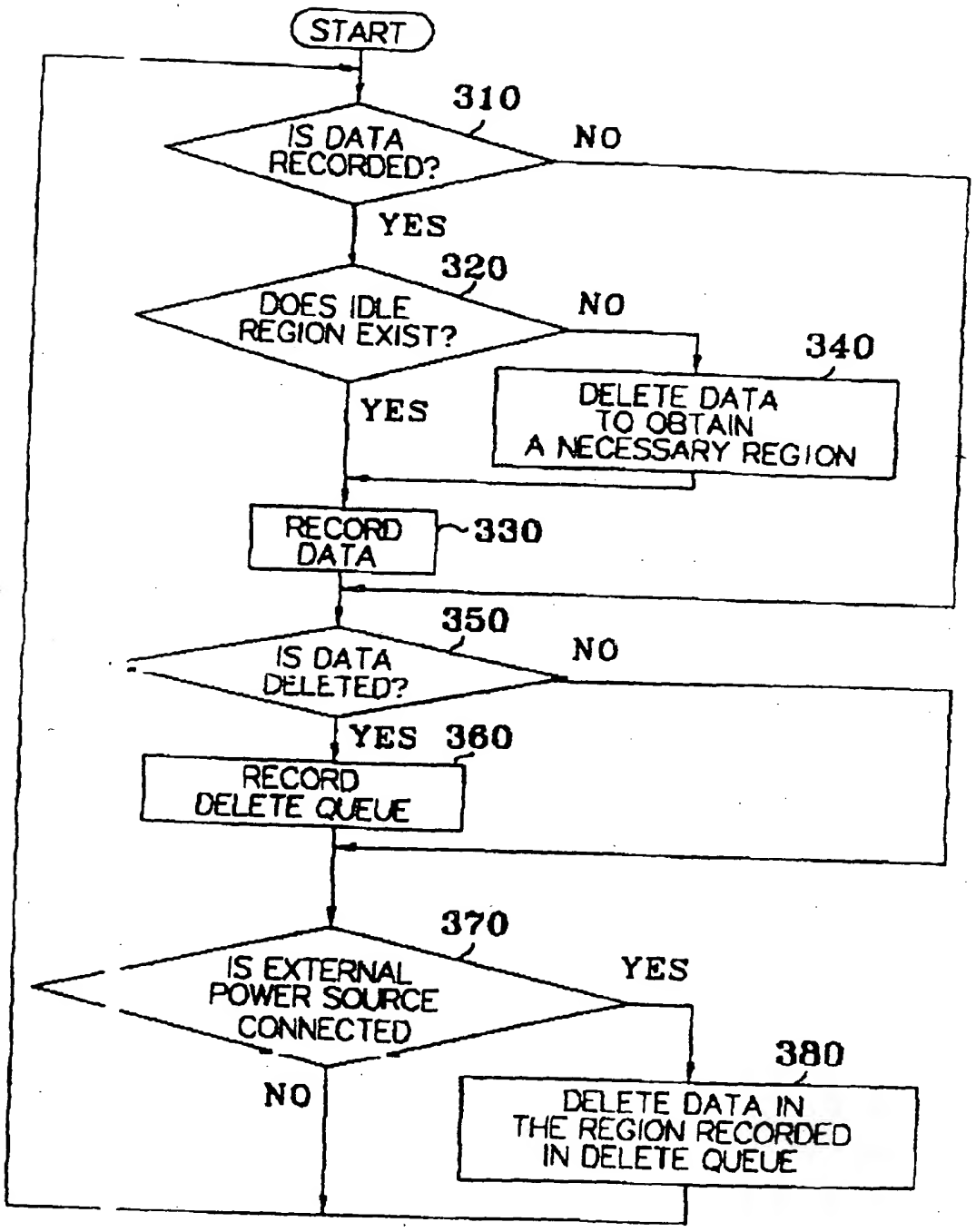

PORTABLE TERMINAL
NON-VOLATILE MEMORY
27
ROM&RAM
26
CPU
25
KEY INPUT UNIT
28
I/O TERMINAL
24
EXTERNAL POWER SOURCE
22
POWER SUPPLY CIRCUIT
23
CELL
21

FIG. 3


START
310
IS DATA RECORDED?
NO
YES
320
DOES IDLE REGION EXIST?
NO
340
DELETE DATA TO OBTAIN A NECESSARY REGION
YES
RECORD DATA
330
350
IS DATA DELETED?
NO
YES
360
RECORD DELETE QUEUE
370
IS EXTERNAL POWER SOURCE CONNECTED
YES
NO
380
DELETE DATA IN THE REGION RECORDED IN DELETE QUEUE